UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

ADMINISTRATION

of

MOUNTAIN PINE BEETLE
(Dendroctonus Monticolae)

CONTROL PROJECTS IN LODGEPOLE PINE

Forest Insect Field Station
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ADMINISTRATION

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INTRODUCTION

With the recognition of the responsibility which rests upon us for the protection of our timber resources comes the need for the development of sound economical methods of control and their application. Control methods must comply with a twofold requirement. Not only must they be entomologically successful but they must be economical to apply. This twofold requirement can be met by the improvement of our present methods of control, or the development of new ones, and the application of these methods in an efficient manner. To comply with the first requirement the research program of the Bureau of Entomology is directed towards the improvement and development of better and more economical methods of control. To meet with the second requirement careful thought must be given to the planning of the administrative features of a project in order that the operation can be directed in an efficient and effective manner.

The margin of safety between success and failure of control projects is unfortunately often a very small one. Careful planning of the administration will often mean success. With the continu-

ation of the Beaverhead - Bitterroot insect control project it seems fitting that the experience of the writer be made available to the forest officers who are to assume its administrative responsibility. Reference is made to the report of the writer under date of November 24th, 1926, covering the recommendations relative to the continuation of this project in 1927. From that report and this paper the readers will readily see that in the administration of insect control projects a line of attack quite different from the usual forest service operation is required.

Though this paper has been prepared for the express purpose of assisting in the administration of the Beaverhead - Bitterroot project it can be applied to lodgepole pine projects of the future. Though many points have been touched upon which to the readers may appear unnecessary they have been included for the purpose of portraying as clearly as possible the actual problems of a control project.

It would be impossible to attempt within this paper the solution of the many problems in connection with the Beaverhead - Bitterroot project, which in 1927 will be conducted on a scale larger than has heretofore been undertaken within this District. It is desired, however, to bring the most important of these points to the attention of the forest officers in charge so that they will realize the need for a careful preliminary planning of the project over which they are to resume responsibility.

The administration of a control project can be placed under two phases which we may call entomological supervision and project

administration. In reality the entomological supervision should be called entomological inspection for the task of seeing that the work is done in accordance with the entomological requirements will no doubt fall upon the project administrative officer.

PROJECT ADMINISTRATION

Project Organization and Administration

Reference is again made to the report from this station under date of November 24th, 1926 (Beaverhead - Bitterroot Forest Insect Control Project) which contains a suggested plan of operation for the starting of this project. It is realized that this plan will no doubt require alterations and additions, however, it was prepared with the idea of giving to the officer in charge a foundation upon which to build his own scheme of attack should he desire to do so. For the convenience of the reader this plan is appended to this paper.

In the formation of a plan of operation it is essential that a thorough preliminary study be made of the project area in order that the work can be properly planned and directed. However, such a plan can only be developed to limits which are governed by the knowledge of the existing infestation. It is therefore important that the insect survey receive first consideration. As the different units are surveyed and the infested trees mapped, the size and location of the camps and the plan of the project can be easily determined. Of course, it is impossible to think of surveying the entire area before actual control work is instituted unless it is done in the fall previous to spring control. However, it should be remembered that

under any plan the spotting, or survey, must be kept sufficiently in advance of the control work in order that the control operation can be efficiently directed. This can best be accomplished by the starting of as many spotting crews as possible a week or ten days in advance of control work. The control organization should be relatively small at first and as the technique of the work is developed it can be enlarged to keep apace with the spotting and to complete the project in the time allotted. If this policy is followed then many of the mistakes which have occurred in the past will be avoided.

In the formation of a plan of operation the camps should be grouped as much as possible around a selected head quarter's camp. This permits of easier and more thorough supervision. The servicing of camps with supplies from the ration dump is simplified and the production records and time slips can be secured practically every day for posting. On the other hand such grouping, though extremely advantageous, must be carefully watched for there is a danger of over concentration which results in long and frequent moves and the ultimate defeat of the objective sought.

To discuss the delegation of the various duties or to outline a diagrammatic organization for this or future projects seems unnecessary as the officer in charge will be governed in the formation of his organization by the personnel with which he is provided. In the administration of large projects this officer must surround himself with sufficient trained assistants who are dependable.

They must be men who have more than just a mercenary interest in the project. They must believe in the importance of the work and be more than willing to do everything within their power to assist in making it a success. Regardless of the character of the organization which is formed on the Beaverhead or any other large scale projects, a project clerk should be provided for. This clerk should be located at the head quarter's camp and be responsible for the posting of all time slips, the keeping of daily production records, the ordering of and the checking out of supplies to each camp, handling of commissary, etc. This relieves the officer in charge of the project from such detail work and permit him to give his time to supervision as he should. The size of a project which will warrant the expense of a clerk will depend upon the ability of the officer in charge to keep the necessary records and give proper supervision to the work. The justification of the expense of a clerk to keep such detailed records as are outlined in the following pages of this paper may be questioned. The explanation for the need of such records is that it is only from a detailed tabulation of the output from each camp, a weekly subsistence cost from each camp, the daily checking of effective man days against the number of men on the pay roll and the cost of transportation, etc., that the leaks within a big project can be detected, prevented and checked during the course of the project, which in turn lowers the cost of treatment and makes the work economically successful. By studying the records outlined in this report the officer in charge can soon tell where his supplies are going, which crew is not measuring up to the proper standard of production and where his noneffective

labor is located. The detail of project organization and administration will be discussed under their various captions.

Camp Organization.

Camp Location - Aside from the necessary requirements of wood, water and site, the question of transportation of supplies and the relation of the camp to the area which is to be covered must receive careful consideration in the location of camps. In the Big Hole Basin it may prove possible to service a large percent of the camps by wagon and team. If this is true then the cost of transportation would be greatly lessened. Though some times this is a relatively simple question due to certain controlling factors, the location of a camp is an important item and should not be minimized. This problem is made a great deal easier if, prior to the establishment of the camp, the area has been completely or even partically covered by the spotters. From the spotters maps the camp can be located centrally to the work which reduces walking time and increases output. All of these factors must be weighed in order to determine the most effective location. If the camp is to be serviced by pack train then its location to roads, trails etc., is of little importance.

Camp Administration - In a camp of one crew the crew foreman becomes the camp manager. In camps of more than one crew a manager is designated, who also acts as a crew foreman. The camp manager will be charged with the responsibility of keeping the time of the men in camp, by keeping of daily production records, the ordering of supplies and

the general supervision of the camp. Each week he will submit on Insect Control Form "A" (See Page 29) a record of the output from the camp and its activity.

Camp Area - The designation of camp areas is important. They must be of sufficient size to justify the establishment of a camp but not to require too great a walking distance to reach the outlying and scattered groups of infested trees. The walking distance, which should consider the character of the terrain to be covered as well as the distance, should be limited to a maximum of two miles and this should be shortened whenever possible. The time lost in reaching trees lying outside of a legitimate walking distance should be weighed against the cost of moving the camp. Long walks should be avoided whenever possible because of the reduction of daily output and the dissatisfaction which it causes within the personnel of the crew. By careful planning of camp areas and camp sites a great deal of this trouble can be eliminated. Provisions should be taken so that not more than one camp is to be moved on the same day. This can be avoided by looking ahead and shortening or enlarging the camp area.

Size of Camp - A careful study of the camp area is necessary to determine the size of the camp which will produce the most effective results. Camps should be of such size that the efforts of supervision will not be dissipated throughout numberless small camps. On the other hand they should not be so large that long and frequent moves are necessary. By weighing these two factors the proper number of crews for each camp area can be determined.

Camp Equipment - During these projects bad weather conditions are always experienced. It is advisable to prepare as comfortable a camp as possible as time and money expended in this manner is more than compensated for in the subsequent satisfaction of the crew. The tents should not be over crowded and it is advisable to have extra tentage available. Extra tentage can be used to good advantage in the moving of camps for if it is previously placed at the new camp site, the amount of transportation required for the move is greatly reduced. This permits the moving of a camp in one day and causes no inconvenience among the men due to the lack of bedding, etc. Following the move, the tentage left behind can be picked up and returned to headquarters or used for other moves. Each tent should be equipped with a Sibly stove. This permits the drying of clothes and assures the comfort of the men during cold mornings and evenings. Ample bedding should be issued to each man and when possible cot mattresses, straw, or hay should be provided for the beds. Some of these details may seem unnecessary. However, it is assured that where comfortable camps and good wholesome subsistence is provided labor troubles are practically eliminated. List of equipment needed for crews on page 21.

Subsistence - Good food is one of the most important factors contributing towards the satisfaction of the crew, and the cook is in most cases directly responsible. There are many varieties of camp cooks and good ones are difficult to secure. There is the wasteful cook and the one who takes an interest in his work and tries

to set a good table economically. Though good wholesome food should be provided, care should be taken to see that rations are not wasted. It may prove that the cook who is apparently giving the best satisfaction is using more expensive rations. It is thoroughly believed that in large projects the misuse and waste of subsistence supplies can develop into a serious leak of expenditures. In a project involving the expenditure of $30,000 to $50,000 an increase cost of a few cents per meal will amount to a considerable sum in a few weeks. This waste and useless expenditure can be avoided by a careful checking of the supplies which are used at each camp. This can best be accomplished by keeping an itemized record on Forest Service Form D.1-39 (prepared in duplicate with one copy to camp manager) of all the supplies sent to each camp. The cost of these items can be extended so it will soon be apparent if any camp manager is exceeding his subsistence allowance on a man day basis. At the end of each week the camp manager will submit with his weekly report (Insect Control Form "A") an itemized inventory (Form D.1-39) of the supplies which he has on hand. This will prevent the accumulation of a large surplus supply of rations at camps which often increases the cost of transportation during moves. This inventory can be deducted from the supplies charged against his camp for the week and the actual cost of subsistence on a man day or meal basis computed. Insect Control Forms "B" and "C" (See pages 30 and 31) have been devised for the tabulation of this data from each camp and the summarizing of results from all camps.

It is realized that in the keeping of these records a certain amount of daily clerical labor is required. However, if kept up to date the work involved will be very little and it is only from such records that a proper analysis of the costs of a project can be secured. In the execution of these reports the number of meals served each week can be secured from the camp manager's weekly report, as well as the time slips.

Camp Personnel.

Crew Foremen - The foreman is the key man of his crew. He should be a man who is trained sufficiently in practical control work so that he can properly supervise the work of his crew. He should not only be able to handle men but he must be a leader, a man who has more than a mere mercenary interest in his job. In nearly every case the production of the crew can be measured by the ability of its foreman. The crew foreman must work. He is given a larger wage in a small crew to compensate for the responsibility which he carries and his duty lies more in leadership than in bossing.

Laborers - The control crew must be made up of workers. There is no place for the man who believes that Government work is a paid vacation. There are no circumstances which justify the keeping of a drone or a trouble maker. It is better for a crew to be shorthanded for a few days than to be handicapped with a gold bricker who feels that a Government project is legitimate prey. Men with wood experience are practically a necessity. An effort should be made to se-

cure sawyers for the felling and bucking of the trees, swampers for limbing and men who have handled horses for skidders. Realizing that this may not always be feasible, men should be hired for the specific wants of the project whenever possible.

Spotters - "Spotting" is the term applied to the location and marking of the infested trees for treatment. It has been found that young men who have observing eyes and keen minds make the best spotters. Men should be selected who are interested in their work and who realize that the first essential step of a project is the proper spotting of the infested trees. If the project is put to the expense of a hundred percent survey then it is important that the spotters be men of sufficient judgement to properly determine which trees should be marked for treatment and which should be passed by. However, it will be impossible to eliminate mistakes in spotting. Spotting is not easy work as it requires lots of hard steady walking. The spotters should receive a slightly larger wage than the crew laborers. The compassman must be able to run a compass and pace accurately, map neatly and correctly and understand the general principles of land survey. The importance of good spotter's maps cannot be over estimated. When accurate the crew foreman will have no difficulty in relocating the marked trees, but when the maps are poorly and improperly made a great deal of lost motion on the part of the treating crews occurs.

Sawfilers - Good "sawfilers" are a necessity. Unless the saws are in good cutting condition the sawyers become dissatisfied

and the resulting production is correspondingly reduced. It is often possible to have men file saws after hours. If no sawfiler is available in camp then it is necessary to have a filer visit this camp at regular intervals. Poor sawfilers, regardless of the wages paid, are a liability rather than an asset.

Cook - The Cook is an important element in camp administration. A cheap cook not only wastes more than is saved in salary but he becomes a medium through which a great deal of dissatisfaction arises in camp. Poor and cheap cooks are false economy and should be eliminated as quickly as possible.

Transportation - The question of transportation is an important item and must not be passed over lightly as mismanagement can result in a serious loss to the project. Where pack trains are to be used entirely there should be sufficient stock to adequately service the different camps and to move them when necessary. A few dollars saved in a shortage of stock is lost many times over in the dissatisfaction of a crew if on a move they are obliged to go without proper tentage, blankets or subsistence. However, unnecessary stock is a liability and should be eliminated. Careful planning will reduce practically all of the transportation difficulties. Where it is possible to use both wagons and pack stock in the servicing and moving of camps the transportation problem is materially reduced. Camps can be moved with a team and wagon quicker and more satisfactory. On the Beaverhead National Forest it is believed that a light wagon and team with the addition of a short pack string will answer the problem of

transportation satisfactorily. The question of contracting the hauling of supplies from the rail head to head quarters camp versus the purchase of a motor truck must receive careful consideration. Though a light truck, perhaps a one ton Ford, equipped with Ruxstell gear, would be very handy and serviceable on the Beaverhead project, it may prove to be more economical to contract this part of the work. The cost of transportation must be spread over the entire project.

ENTOMOLOGICAL SUPERVISION

Training of Personnel

It is impossible to start an insect control project at full speed without a tremendous loss of time and money. It must be developed slowly, increasing to a maximum as sufficient personnel is trained to supervise the additional camps and crews. Reference is made to the plan of operation for the Bitterroot - Beaverhead project which is appended to this report.

The men who are to act as assistants to the officer in charge of the project, unless they have had previous experience, should be given a few days special training. These men are then prepared to assist in the organization and training of the spotting crews who should be assembled from one week to ten days before the actual control work is started. Though money spent in training personnel will prove an economical expenditure it must not be over done. This training should be carried on by doing actual control work. Have your assistants spend a day in actual spotting, another in doing control work, etc. It will prove to be the best school and some produc-

tion will be secured from their training.

The control work should be started on a reasonably small scale, perhaps two crews at the training camp, as the spotting will be further advanced in that region. As rapidly as the spotting is advanced into the other areas additional control crews should be organized. Care should be exercised in the selection of men for these first crews as it is from this nucleus that foremen for additional camps should be drawn. This plan cannot always be followed but should be practiced when possible.

SPOTTING CREWS

After the expense of establishing a control camp within an area it is essential that all of the infested trees within that region be marked for treatment. In areas where the infestation is extremely heavy it will often be possible to institute control work without advance spotting. However, after the large blocks of infestation have been cleaned up by the control crews it may be necessary to survey the region for the scattered trees which have been missed. Though various methods of locating these infested trees have been tried a 100 percent survey gives the most satisfactory and economical results. There is practically no foliage discoloration of the infested trees until June which necessitates the examination of every tree. The chief of each spotting crew is charged with the proper direction and supervision of the insect survey and is directly responsible to the officer in charge of the project. In addition to this supervision he must keep a daily record of his crew which is forwarded to the project manager every week or whenever called for. Insect Control Form "H" (see page 36(

is used for this report. The compassman runs the course, paces the distance and maps the infested trees on Forest Service map sheets (form 878). In addition to the mapping of the infested trees he should include distinct topographical features upon his map, as they assist the crew foreman in relocating the marked trees for treatment. Each spotter cruises a strip one chain wide and in order to cover it thoroughly must weave back and forth in order to examine all susceptible trees. The responsibility of determining which trees should be marked for treatment and which should be passed rests upon the spotting crew. When in doubt the spotters should appeal to the compassman or chief of party. If the questionable tree is one of a group the additional expense of treating is very small and will often be less than the time lost by the spotters in making the detailed examination necessary for positive marking.

Each spotting crew is designated by a letter symbol which is used in connection with the tree numbers, i.e. A1, A2, or B1, B2, depending upon the crew. This permits the use of consecutive numbers by each crew with no danger of overlapping. Each spotter is equipped with a light hand axe, marking crayon and tacks. When he locates infested trees he cries "bugs" which stops the compassman who assists in the marking of the trees. The trees are then marked with a white cloth tags(sign painter's cloth, 4X6 inches) which are carried by the compassman in order that the trees will be marked with consecutive numbers. These tags are prepared in camp and contain the letter symbol of the crew, the number of the tree, a space for the D. B. H. and the length treated (see page 37). These tags are fastened to the

trees with two tacks, one at each corner of the top. In addition to the tag the spotter makes a blaze on the tree on which he marks a "T" (which means treat). This extra work is believed necessary as a small percent of the tags are destroyed and the crayon mark will assist the crew foreman in locating his missing numbers. These cloth tags are a great help in relocating the groups of trees for treatment as they can easily be seen for several hundred feet where as a blaze is easily passed by. In marking a group of trees the tags should be placed on different sides in order that the group can be seen from any approach. They also serve as a record of the trees treated as they are turned in each night by the crew foreman. If one spotter runs into a group of infested trees, the other spotter assists in the location and the marking. All of the trees of each group should be marked at the time it is discovered regardless of the fact that it may extend into the next strip. This gives consecutive numbers for each group and assurance that all trees are marked. In a region which has been surveyed, the spotting should be conducted by section. Where no land survey has been made it will be necessary to establish base lines along trails, roads, streams, ridges, etc., in the same manner that a timber reconnaissance is conducted.

It has been found that a three man crew gives the best results, however, five men may be used satisfactorily. By using a five man crew one compassman is eliminated and the same ground covered as by two three-man crews. With a three man crew it is believed that if the compassman would watch the trees directly in front of him each

spotter could cover a strip one and one-half chains wide.

CONTROL CREWS

The foreman is charged with the responsibility of directing his crew, the relocation of the marked trees for treatment, the collecting and filling out of the data required on the tree tags, the checking of his tags against his map in order to see that no trees have been missed, the proper execution of the work and the checking with the camp manager of results accomplished each day. The personnel and organization of a crew will vary with the method of treatment used and the sanitary regulations required. Where the infested logs are decked and burned as on the Beaverhead National Forest in 1926 and where it was required that all brush be piled and burned it was found that a seven man crew gave the best results. These crews were organized as follows: one crew foreman, two sawyers, one swamper, one skidder and horse, and two burners. The proper equipment required for a seven man crew is listed on page 22. The trees were felled, limbed and the infested length cut into twelve to sixteen foot logs, skidded into decks and burned. Where high stumps are left it is necessary to peel them which is an expensive operation. If these stumps could be cut to 6 or 7 inches, very few insects would be missed and peeling would be unnecessary. There would also be an entomological advantage to this plan as many predacious insects pupate at the base of the tree and are undoubtedly destroyed by peeling. In order to be sure that the entire infested length of the trees had been treated a fool proof rule was given to the sawyers. This rule called

for the cutting of sufficient logs to a point where the sap wood became clear. As long as any blue stain showed it was necessary for the sawyers to remove another log. This, of course, resulted in the unnecessary treatment of a certain portion of the logs. However, this additional expense which was very small was justified by the removal of the need for the examination as to the height of the infestation. A single work horse was found to be sufficient to skid these logs. A chain was used in skidding and was fairly fast giving very good results, however, it is possible that a light pair of skidding tongs can be devised which would be more satisfactory. During wet weather it is necessary to pile some dead and dry wood into the bottom layer of the log decks in order to insure a good burn. It is essential that all decks be built at least three, and more if possible, logs high in order to create the necessary draft for a successful burn. The brush can be burned on these decks or in separate piles. In the disposal of the brush the skidder can help materially by dragging the tops of the trees out into the open for the pilers. Care must be exercised in the location of the log decks in order to avoid fire injury to standing trees and reproduction. Where it is impossible to avoid injury to a small tree or two they should be cut down and placed on the decks. Except in very wet weather a fire trench must be placed around the decks before burning. These trenches must be placed at a sufficient distance (at least six feet) from the decks to prevent the fire from jumping due to the intense heat.

A crew should be organized with the idea of treating each day

the maximum cut of the sawyers. The swamper, skidder and burners should work closely together as it is part of the swamper's duty to assist the others in the decking of logs and the burning of brush whenever possible. A greater average production with better supervision will be secured when the work is fairly well cleaned up at the end of each day. In the securing of and working towards an increased output from the different crews care must be exercised to see that there is no lowering in the standards of control work.

As soon as the woods become so dry that fires built during the day require constant watching then it is advantageous to institute night burning. Under this system the trenched log decks are prepared during the day and fired in the evening after 7 p.m. Though it is unnecessary to watch these fires during the night they should be visited in the morning for the purpose of catching any possible spark in rotten wood, etc., which would perhaps cause trouble during the day. This system can be practiced through the month of June with no danger. Though fire is a dangerous weapon and requires care in its use it is recommended that the burning method of control be used whenever the topography of the region permits as it will be found to be more economical than peeling. However, on steep slopes with thick and heavy timber stands this method will not be feasible or economical.

When an area is to be covered entirely by the peeling method of control and the brush piled and burned, the best organization will be a seven or eight man crew. Two fallers cut, limb and measure the infested length of the trees while the remainder of the crew peel the

bark and pile and burn the brush. It is possible that some trees can be peeled more economically while standing than by felling. Though this premise is regognized as being sound, the decision of determining just how high the tree should be peeled is a difficult one to make until it is cut. If this practice is generally followed then it will be found necessary to fell many trees after they have been peeled because of the inability of the peelers to reach the entire infested length.

When a combination of the burning and peeling methods is required as is believed will be necessary on the Bitterroot, the crew should be organized for the method which will be used the most and merely adjusted to the other as it occurs. Familiarity on the part of the crew foreman with the area ahead will aid in determining which method is to be used each day.

Quite often on the edge of forests and around open parks there will be found low shrubby, heavy limbed infested trees of a large diameter. These trees are the most expensive to treat under either method and especially by peeling. It is possible that by piling some dry brush at the base of the tree and the leaning of a small tree or two on the windward side, to act in the capacity of a flu, that these trees can be scorched sufficiently while standing. However, it should be remembered that the bark must be very severely scorched in order to destroy the insects beneath.

EQUIPMENT LIST

Headquarter's Camp.

There should be on hand at all times an adequate supply of control record forms, map sheets, marking tags, pencils, colored crayons, stationery, time slips and Forest Service forms necessary for the proper execution of the project. There should also be a small emergency supply of equipment including such items as tents, bedding, single trees, harness tugs, chains and skidding tongs, marking hatchets, axes, axe handles, saws, etc. At this camp there should be the necessary tentage or buildings for storing of supplies and an office building or tent should be equipped with gasoline light, portable typewriter, slide rules, etc. A commissary of the items in general use by the men should be carried.

Camp Equipment.

1 12X14 cook tent.
1 14X28 fly for shelter over table.
1 7X9 store room tent (not necessary for small camps.)
1 16X16 pyramidal tent for every six men in camp.
1 Kimmel cook stove. Necessary Forest Service mess equipment (varying with size of crew).
1 Sibly stove for each sleeping tent in camp.
1 damper for each Sibly stove.
7 lengths of stove pipe for each Sibly stove.
1 sawfiling outfit and files.
1 hammer, claw.
1 first aid kit, large.
1 saw, hand.
Assorted nails.
Wash Basins.
1 shovel, L. H. R. P.
1 mattock
4 blankets, wool, single, for each man in camp.
1 blanket, double, cotton, for each man in camp.
1 7X14 tarp for each man in camp.

Control Crew Equipment.

2 saws, cross cut, 5½ or 6 feet.
1 axe, D. B. 3¾ pounds, for each man in crew.
1 shovel, L. H. R. P.
2 2½ gallon water bags.
1 coffee pot, 1½ or 2 gallons for crew lunches.
1 sledge, light.
1 wedge, 2 pounds, thin, falling.
3 carborundum stones, round, pocket.
1 skidding horse.
1 harness, strong.
1 skidding chain or tongs.
2 single trees.

Spotting Crew.

1 compass. Forest Service standard with socket joint.
1 leather carrying case for compass.
1 axe belt for compassman.
1 axe, light, for each spotter. (Belt axes satisfactory).
1 carrying case, canvas, U. S. F. S.
1 aluminum map sheet holder.
2 tally registers.
Pencils, regular and colored.
Erasers and carbon, etc., Carbon Paper for duplicate maps.
Tree tags, map sheets, weekly reports, etc.

KEEPING OF RECORDS

Sample forms for the keeping of cost and production records are submitted with this report. The importance of these records has been previously discussed so but a brief discussion of each form and its use follows.

Forest Service Form D.1-39.

This form is to be used by the project clerk in keeping the record of the supplies sent to each camp and by the camp managers for submitting their weekly invoice of supplies on hand. This form should be executed in duplicate so that the camp manager can be supplied with

a copy which will show him the supplies which he has received. From these two records the cost per meal for each week can be secured.

Insect Control Form "A".

This form is used by the camp manager in submitting a weekly report of the activities of his camp. On this form he keeps a daily record of trees treated by each crew and the number of effective man days for each crew; the number of meals served each day in camp which should check with the time slips, the amount of noneffective labor during the week and remarks relative to personnel, equipment needed, etc.

Insect Control Form "B".

This form is used by the project clerk or administrative officer in determining the cost of subsistence at the different camps. From the sample submitted (page 30) it is believed that this form can be easily executed.

Insect Control Form "C".

This form is but a suggested heading for the weekly summarizing of the different results obtained from the different camps which is shown on Form "B".

Insect Control Form "D".

This form is used by the project manager or clerk to keep a daily record of the trees treated by each crew, their numbers, the D. B. H. and length treated. This data is secured from the tags

taken from the treated trees and which should be forwarded to the headquarters camp as often as possible. These tags should be kept separate for each crew and for each days work. When these tags are received the information which they contain is transferred to this form which groups the output of each crew, and gives a basis for the computing of cost records. It is then necessary to check the tree number of the treated trees against a list of consecutive numbers in order to make sure that no trees have been missed. For this list of numbers Forest Service log scale books (258a) prove very satisfactory. These books contain one thousand numbers and a book can be kept for each spotting crew marked with their designating symbol.

Insect Control Form "E".

This form is used to tabulate the production record and labor cost of treatment for each crew. The explanation of this form follows.

MAN DAYS.

Per Day - Number of man days actually contributing to each day's output. Time put in on fire suppression or other labor resulting from actual control work must be charged against that day's output.

Total for Month - Secured by taking the total number of man days per month.

TREES TREATED.

Per Day - Number of trees actually treated each day.

Total for Month - Secured by taking the total number of trees treated each month.

Per Man Day Per Day - Secured by dividing the actual number of trees treated each day by the number of man days actually contributing to the daily output.

Per Man Day Per Month - Secured by dividing the total number of trees treated by the total number of man days.

LABOR CHARGES.

Per Day - Net wages paid men actually contributing to the daily output of treated trees.

Per Month - Secured by totaling the daily charges.

COST PER TREE LABOR ONLY.

Per Day - Secured by dividing the daily cost of labor by the total number of trees treated.

Per Month - Secured by dividing the total monthly cost by the total number of trees treated.

Insect Control Form "F".

This form is but a suggested heading for the weekly summarizing of the results accomplished by each crew. It is strongly recommended that each week this form be posted at each camp. If competition between the different crews can be started production is greatly increased. It is recognized that this may have no effect whatever on some crews or upon their foreman. However, this fact will soon be determined and if the foreman or his crew shows no desire to measure up to the standard of the other crews then a change in crew personnel or organization is needed.

Insect Control Form "G".

This form which is prepared by the project manager or clerk is for the purpose of summarizing the costs of the project at the close

of each week. The data as to effective man days is secured from insect control from "E" while the record of expenditures is taken from the time slips and Forest Service forms 877. As all labor and expense contribute towards the actual production of the control crews the expenditures on this form have been reduced to an effective control crew man day. By totaling the expenditures per effective man day and dividing by the number of trees treated per effective man day the treating cost per tree is secured. This figure can easily be checked by dividing the total expenditures for any period by the total number of trees treated during that time. From this form the project manager can see the relation which the expenditures of the past week bear to the past average for the project. He will also be able to pick up unnecessary expenditures relative to transportation, etc.

Insect Control Form "H ".

This form is prepared by the chief of each spotting crew for the purpose of reporting to the project manager the results accomplished during the past week as well as general information relative to the amount of territory remaining to be covered from the present camp and the amount of time required. Suggestions as to the location of the control camps in order that they may be centrally located to the trees marked and information relative to the moving of the spotters camp should also be included. Though this report is intended primarily as a weekly report it should be submitted by the chief of

party whenever he has information of value to the project manager or when called for.

Marking Tags.

A sample of the tags used in marking the trees for treatment is shown on page 37. This tag is made from sign painter's cloth and should be approximately 4X6 inches in size. The tag contains the symbol of the spotting crew, the tree number, and spaces for the diameter and length treated.

LIST OF FORMS AND BY WHOM SUBMITTED

Form		Page	Submitted By.
F. S. Form D.1-39	-	28	Project Clerk and Camp manager.
Insect Control Form "A"	-	29	Camp Manager.
Insect Control Form "B"	-	30	Project Clerk.
Insect Control Form "C"	-	31	Project Clerk.
Insect Control Form "D"	-	32	Project Clerk.
Insect Control Form "E"	-	33	Project Clerk.
Insect Control Form "F"	-	34	Project Clerk.
Insect Control Form "G"	-	35	Project Clerk.
Insect Control Form "H"	-	36	Chief of Spotting Crew.
Marking Tags.	-	37	Chief of Spotting Crew, and Crew Foreman.
Sample Map Sheet.	-	37a.	Chief of Spotting Crew.

Form D. 1-39
(Revised Jan., 1926)

DUPLICATE

REQUISITION AND INVOICE

Order No. _____

_____ FOREST

Ordered by _____

Date of order _____

To _____ District

Destination _____

APPROPRIATION

Charge _____ % _____ FY 192

Charge _____ % _____ FY 192

Charge _____ % _____ FY 192

Charge _____ % _____ FY 192

Item	Unit		Amount ordered	Amount shipped	
Flour:					
White, 3/25-lb	Bale				
Graham, 9-lb	Sack				
Leavening:					
Soda	Lb				
Yeast, 5-ck	Pkg				
Baking powder	Lb				
Cereals:					
Rolled oats, 9-lb	Sack				
Farina, 9-lb	Sack				
Cornmeal, 9-lb	Sack				
Cornstarch	Lb				
Rice, 3-lb	Sack				
Meat and Lard:					
Ham, 12–14 lbs	Lb				
Bacon, 8–10 lbs	Lb				
Roast beef, 24/2	Case				
Roast beef, 24/1	Case				
Salmon, 48/1	Case				
Lard, 4-lb	Pail				
Lard, 2-lb	Pail				
Dairy Products:					
Butter, 2-lb	Tin				
Butter, 1-lb	Tin				
Milk, tall (48)	Case				
Milk, small (96)	Case				
Cheese, 1-lb	Box				
Eggs, evap., 24/2-doz	Case				
Eggs, case, 30-doz	Case				
Beverages:					
Coffee, 2-lb	Can				
Coffee, 1-lb	Can				
Tea, black, ¼-lb	Pkg				
Tea, green, ¼-lb	Pkg				
Cocoa, ½-lb	Can				
Sugar and Sirup:					
Sugar, 4/25	Bale				
Sirup, 24/2½	Case				
Vegetables:					
Beans, lima, 10-lb	Sack				
Beans, navy, 10-lb	Sack				
Beans, red, 10-lb	Sack				
Carrots, Cabbage, Onions, Potatoes — if desired	Lb				
Macaroni, 24/1	Case				
Tapioca, ½-lb	Pkg				
Vegetables, Canned:					
Corn, 24/2	Case				
Carrots, 24/2½	Case				

Item	Unit		Amount ordered	Amount shipped	
Vegetables, canned—Con.					
Beans, cut, 24/2	Case				
Peas, 24/2	Case				
Pork and beans, 72/6 oz	Case				
Pumpkin, 24/2½	Case				
Sauerkraut, 24/2½	Case				
Spinach, 24/2½	Case				
Sweet spuds, 24/2½	Case				
Tomatoes, 24/2½	Case				
Canned Fruit:					
Apples, pie, 24/2½	Case				
Peaches, 24/2½	Case				
Pineapple, 24/2½	Case				
Raspberries, 24/2	Case				
Fig jam, 24/1	Case				
Loganberry jam, 24/14	Case				
Apricot jam, 24/1	Case				
Dried Fruit:					
Apricots, 5-lb	Cart				
Peaches, 2-lb	Cart				
Prunes, 5-lb	Cart				
Raisins, 24/15-oz	Case				
Relishes, Extracts, Spices:					
Catsup, 24/1 bot	Case				
Pickles, dill, 24/2½	Case				
Pickles, dill, 6/10	Case				
Pickles, sweet, 24/2½	Case				
Vinegar, 24/22-oz	Case				
Vanilla extract, 4-oz	Bot				
Lemon extract, 4-oz	Bot				
Mustard, prepared, 9-oz	Jar				
Nutmeg, 4-oz	Can				
Ginger, 4-oz	Can				
Cinnamon, 4-oz	Can				
Pepper, black, 4-oz	Can				
Salt, 3-lb	Sack				
Soaps, etc.:					
Soap, laundry	Bar				
Soap, toilet	Bar				
Cleanser, Dutch	Can				
Chloride of lime, 14-oz	Can				
Miscellaneous Supplies:					
Matches, 20-cart	Case				
Candles (6)	Set				
Special:					

Filled by _____ Date _____ Packed by _____ Date _____

Cargoed by _____ Date _____ Received by _____ Date _____

Shipped on

Waybill or Gbl. No. _____ Date _____ Person receiving above listed items *shall* note on back of form all shortages and damaged goods.

GOVERNMENT PRINTING OFFICE 8—5341a

Insect Control Form "A"

CAMP MANAGERS WEEKLY REPORT.

Week of _____ to _____.

PRODUCTION RECORD

Day	_____ Trees Treated	Crew Man Days	_____ Trees Treated	Crew Man Days	_____ Trees Treated	Crews Man Days
M						
T						
W						
T						
F						
S						
S						
Totals						

Meals Served

Day	Number
M	
T	
W	
T	
F	
S	
S	

Noneffective Labor

	Man Days	Remarks
Moving Camp		
Establishing Camp		
Fire Suppression		
Cutting Wood		
Total for Week		

REMARKS:

Signed _____
Camp Manager

Insect Control Form "B".

Camp Mgr. _____

Camp Cook _____

CAMP RECORD OF SUBSISTENCE

Date May	Supplies Charged	Inventory Credit	Supplies Used	Number Meals	Cost per Meal	Cook and Helper Wages	Cook and Helper Cost per Meal	Total cost per Meal.
1	$150.00							
3	25.00							
4	10.00							
6	75.00							
7	$260.00	30.00	230.00	450	0.51	$40.00	0.09	0.60
9	100.00							
10	50.00							
12	75.00							
14	225.00	40.00	185.00	450		40.00		
		Totals	415.00	900	0.46	80.00	0.09	0.55
15	100.00							
16	10.00							
18	60.00							
19	20.00							
21	190.00	20.00	170.00	450		40.00		
		Totals	585.00	1350	0.43	120.00	0.09	0.51
22	150.00							
24	50.00							
28	200.00	50.00	150.00	450		40.00		
		Totals	735.00	1800	0.41	160.00	0.09	0.50

Insect Control Form "C"

SUMMARY OF SUBSISTENCE COSTS.

Cost per Man Day - Including Supplies, Cook and Helper.

Week	Ridge Camp.	Sawmill Camp	Clam Valley Camp	Bender Camp	Pintlar Camp	Camp
May 1-7	.60	.61	.45	.39	.70	
May 8-14	.58	.57	.45	.42	.60	
May 15-21	.53	.52	.43	.43	.55	
May 22-28	.44	.44	.44	.44	.44	

Week	Camp	Camp	Camp	Camp	Camp	Camp

Insect Control Form "D" No. _____

CREW FOREMAN'S DAILY REPORT

Camp _____ Unit _____ Unit Area _____

Date _____ Man Days _____ Horses _____

_____
Signature

Tree No.	D.B.H.	Length Treated	Tree Remarks	Tree No.	D.B.H.	Length Treated	Tree Remarks
B 1521	30	60					
B 1522	12	34	P.S.				
B 1523	16	50					
B 1524	12	10	P.S.				
B 1525	32	—	B.S.				
B 1526	8	—	U.T.				

Insect Control Form "E"

CREW RECORD FOR MONTH OF _____ 1927.

Foreman.# John Doe

DATE June	MAN DAYS Per Day	MAN DAYS Total for Month	NUMBER OF TREE TREATED Per Day	NUMBER OF TREE TREATED Total for Month	Per Man Day Per Day	Per Man Day Per Month	LABOR CHARGES* Per Day	LABOR CHARGES* Per Month	LABOR COST PER TREE Per Day	LABOR COST PER TREE Per Month
1	7	7	15	15	2.14	2.14	$23.00	$23.00	$1.53	$1.53
2	7	14	44	59	6.28	4.21	23.00	46100	.52	.78
3	7	21	30	89	4.28	4.24	23.00	69.00	.77	.78
4	7	28	40	129	5.71	4.61	23.00	92.00	.57	.71
5	7	35	41	170	5.85	4.85	23.00	115.00	.56	.68
6										
7	7	42	41	211	5.85	5.02	23.00	138.00	.56	.65
8	7	49	43	254	6.14	5.18	23.00	161.00	.53	.64
9	7	56	52	306	7.42	5.46	23.00	184.00	.44	.60
10	6	62	43	349	7.16	5.63	20.00	204.00	.47	.58
11										
12										
13										
14										
15										
16										

* Labor charges include cost of skidding horses.

Insect Control Form "F"

WEEKLY SUMMARY OF CREW RESULTS

Week of June 8 to June 14.

Crew Foreman	Trees Treated	Average per Man Day: Week	Average per Man Day: Month	Remarks
Terrell	270	6.28	5.66	
West	157	5.24	5.46	Moved camp on 14th.
Ferguson	200	4.39	4.26	
Olson	144	3.52	4.56	
Bauer	169	3.38	3.82	Worked on Sunday
Total	940			

Insect Control Form "G" Week Ending June 7, 1926

RECAPITULATION OF EXPENDITURES BASED ON EFFECTIVE MAN DAYS OF CONTROL CREWS

Total E. M. Days brought forward	546	Trees per E. M. Day brought forward	4.10
Total E. M. Days this week	197	Trees per E. M. Day this week	4.63
Total E. M. Days for project	743	Trees per E. M. Day for project	4.23

Summary of Expenditures

ITEMS	Brought Forward Total Last Week Expense	Per E.M.D.	This Week Expense	Per E.M.D.	Total For Project Expense	Per E.M.D.
SUPERVISION						
Overhead	200.00	.366	50.00	.254	250.00	.336
Camp Clerk	100.00	.183	25.00	.127	125.00	.168
Saddle Horses	40.00	.073	10.00	.050	50.00	.067
	340.00	.622	85.00	.431	425.00	.571
LABORERS						
Crew Foremen	312.00	.571	120.00	.609	432.00	.581
Crew Laborers	1404.00	2.571	501.00	2.543	1905.00	2.564
Spotters	546.00	1.000	126.00	.639	672.00	.904
Skidding Horses	78.00	.143	30.00	.152	108.00	.145
	2340.00	4.284	777.00	3.943	3117.00	4.195
SUBSISTENCE						
Cooks	200.00	.366	75.00	.381	275.00	.370
Flunkies	75.00	.137	20.00	.101	95.00	.128
Supplies (Rations)	1500.00	2.747	394.00	2.000	1894.00	2.549
	1775.00	3.250	489.00	2.482	2264.00	3.047
TRANSPORTATION						
Packers	100.00	.183	25.00	.127	125.00	.168
Truck Drivers						
Hired Trans.	75.00	.137	25.00	.127	100.00	.135
Pack Horses	100.00	.183	25.00	.127	125.00	.168
Gas, Repairs, etc.	20.00	.037	10.00	.050	30.00	.040
Horse Feed	60.00	.109	25.00	.127	85.00	.114
	355.00	.649	110.00	.558	465.00	.626
EQUIPMENT						
Saws, Axes and Hammers	200.00	.366	25.00	.127	225.00	.303
	200.00	.366	25.00	.127	225.00	.303
TOTALS	$5010.00	9.171	1486.00	7.541	6496.00	8.740
Cost Per Treated Tree:		$2.24		$1.63		$2.07

Insect Control Form "H"

SPOTTERS WEEKLY REPORT

Date _____ Location of Camp _____

Crew Symbol _____ Number of Men in Crew _____

Record of Trees Marked for Treatment

Date	Number of Trees	Sections or Area Worked	Remarks

Remaining territory to be covered from present camp _____

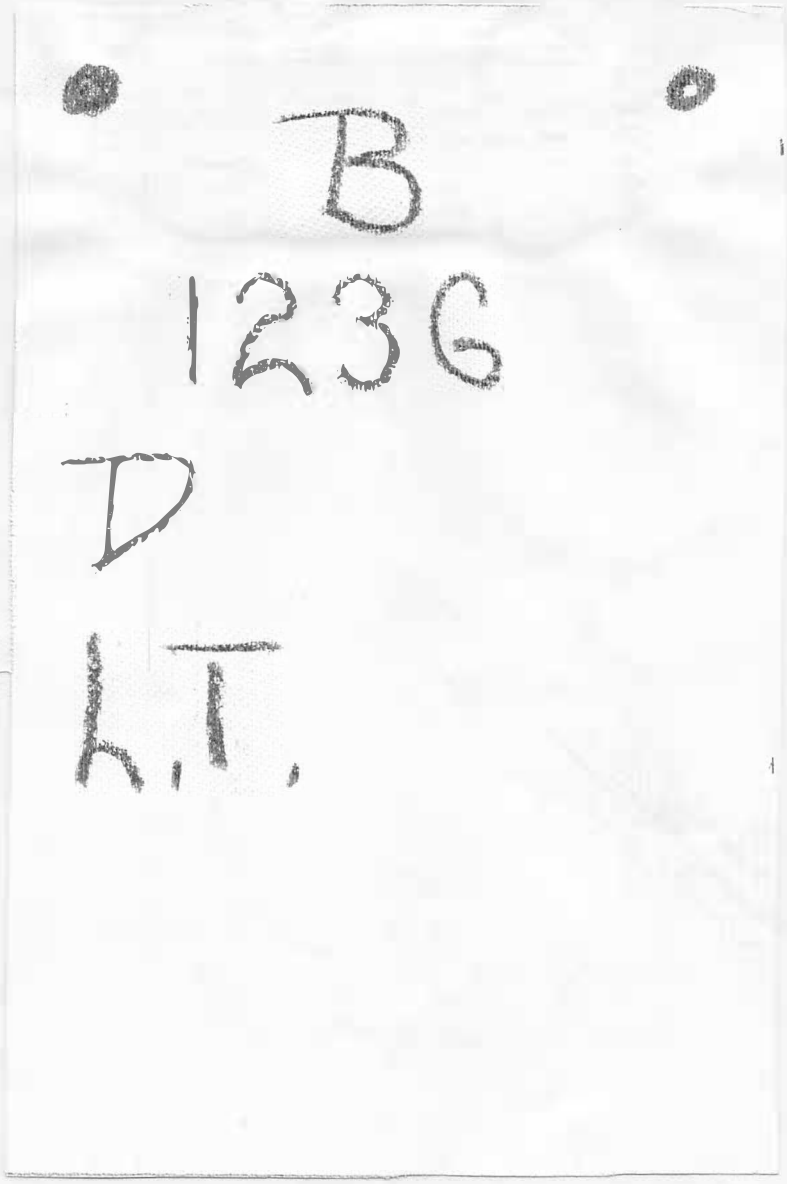
Number of days required to complete present camp area _____

Suggestions as to location of control camp in present area _____

Suggestions as to new location for spotters camp _____

Remarks. (Suggestions, Requirements, Etc.) _____

Signed _____
Chief of Spotting Crew.



SAMPLE MARKING TAG

These tags are made from Columbian Sign Painter's Cloth. They can be cut at a printing office very nicely at practically no expense. At retail price they would not cost more than $0.25 a hundred.

UNITED STATES DEPARTMENT OF AGRICULTURE—FOREST SERVICE

_____ Land District. Mag. Declin. _____ Area _____ Acres

Sec. 4 T. 1 S. R. 16 W. Mer. Scale _____ inches = 1 mile

(Case designation.) (Subdivision and section.)

Field work by J.D, Date _____, Platted by J.D

Remarks: Tree No. 500 – 639 Inclusive

_____ Approved _____, 19____, _____

(Approving officer.)

Form 878
(Revised April, 1916)

8—433

COST DATA TO BE SECURED

In the past it has been impossible to compare the costs of one control project against another due to the fact that the same data was not secured. Though the writer has prepared a series of forms which are outlined within this paper and if adopted will provide the necessary data for a proper cost analysis of the project, they are not meant to be obligatory. It is possible that the project chief may desire to institute a partically or entirely different system. However, under any system of accounting the following data should be secured.

Supervision.

This item should include the salaries, expenses, etc. of the men actually engaged in supervision and not taking an active part in spotting or control work.

Laborers.

Control Crews.

1. Number of effective man days.
2. Cost per effective man day for wages only.
3. Cost per skidding horses.
4. Number of trees or M. B. F. treated per man day basis.

Spotters.

1. Number of effective man days.
2. Cost per effective man day for wages only.
3. Number of trees marked per effective man day.
4. Number of acres covered per effective man day.

Subsistence.

1. Cost of rations on a man day or meal basis.
2. Cost of cooks on a man day or meal basis.
3. Cost of flunkies on man day or meal basis.

Transportation.

This item includes the hire of pack horses, motor cars, packers, truck drivers, feed, gasoline, horse shoeing, repair bills, etc., These items should be kept separate for a proper analysis.

Equipment.

This item includes the cost of equipment such as tents, bedding, axes, saws, grind stones, etc. However, it is not fair to charge the project during any one year with the total cost of this equipment. It is felt that the project should not be charged with more than one-third of the total cost which is believed to be a fair depreciation.

Effective Man Days.

In computing the cost per tree or M. B. F. on a man day basis only the actual control, or treating crew, time labor is considered as effective time. Though, of course, the spotting, packing, cooking, etc., is all effective labor it is only considered as contributing to the actual control operation. Therefore the effective man days should be kept so that it can be separated from the project man days which includes all paid labor within the operation.

LIAISON BETWEEN SUPERVISORS OFFICE AND PROJECT MANAGER

The project manager should be immediately notified of all charges or vouchers drawn against the project allotment. It is only from such efficient liaison between the office where the accounts are paid and the field that the project manager can keep himself informed as to the exact status of his allotment and the costs of the work. These notices should not only contain information as to the amount of the vouchers drawn but as to the material which was purchased. This in-

formation is necessary for the segregation of expenses in order to eliminate unnecessary expenditures. It is suggested that a form similar to that shown below be devised and which should be executed and mailed to the project manager at the time the voucher is drawn.

_____FOREST INSECT PROJECT.

Date _____ Amount of Voucher $_____

Drawn in Favor of _____

Nature of Expenditure _____

_____

_____

Remarks _____

Signed _____

RATION LIST

An accepted ration list applicable to the supplies on hand should be available to the project manager or clerk. Such a ration list if used would greatly assist in the servicing of camps. Its best use would be in the determination of the proper amount of rations to supply to a newly established camp. This would eliminate the shortages that usually occur a day or two later and which increases the cost and difficulties of transportation.

Camp managers should be instructed to order their supplies on a weekly basis whenever possible. However, care should be exercised to prevent over ordering that results in the accumulations of a surplus at the different camps which increases the difficulties of transportation during the next move as well as the reduction of the stock at the headquarters camp.

MOUNTAIN PINE BEETLE

The adult insect, which is a stout, black, cylindrical bark-beetle about one-fifth of an inch in length, bores through the outer bark and constructs a long perpendicular egg gallery in the thin layer of cells directly between the living bark and the wood. Along this gallery eggs are deposited which soon hatch into small grubs, or larvae. These white, legless larvae excavate short mines at right angles to the egg gallery which terminate in a cell in which the transformation to the adult beetle takes place. The combined result of these egg galleries and larval mines is a complete girdling of the tree which causes its death.

When the transformation is complete the new adults bore emergence holes through the outer bark. By boring away the intervening bark between the cells, several beetles may use the same emergence hole, or take advantage of cracks or other openings through the bark. The principal emergence of the beetles occurs during the latter part of July and early August. The new attack occurs during the latter part of July and August and the winter is passed by the insect in an

immature larval stage. Pupation or the transformation from the larvae to the new adult beetle occurs during the latter part of June varying somewhat with the season. Though the new adults are formed by the latter part of June the general emergence does not occur until the latter part of July.

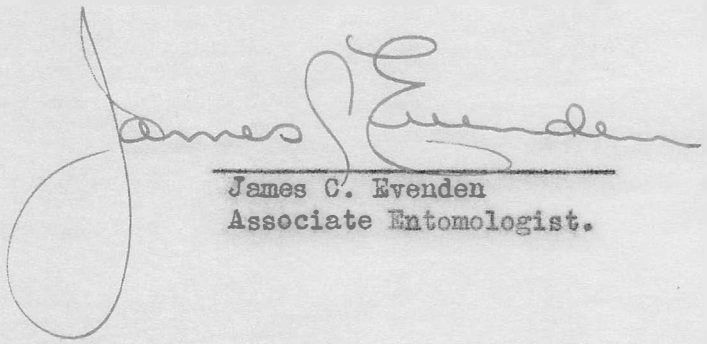
Insect infested trees can be located by the faded foliage, by boring dust at the base of the trees, or by the pitch exudations at the mouth of the entrance tunnels. However, as there is but very little discoloration of the foliage of infested lodgepole pine trees prior to June it is necessary to depend almost entirely upon the boring dust and pitch tubes for spotting.

Control work can start as early in the spring as the crews can be taken into the woods, which for the most part will depend upon snow conditions. Where the infested trees are being burned control operations could continue under ordinary seasonal conditions to the first of July. However, it would be best to plan for the completion of the work by June the 15th or 20th. Where the trees are being peeled the work should close by June the 15th as the new adults are fully formed by that date. Though early spring seasons permit the starting of control measures at an earlier date no advantage in the length of working time is gained due to the advanced development of the insect broods. Late season, of course, have the opposite effect and it is possible to continue the operation to a later date.

CONCLUSIONS.

As previously stated the writer has not attempted to solve the problems of the Beaverhead - Bitterroot control project within this paper. It is hoped, however, that most of them have been portrayed in such a manner that the officers who are to assume the administrative responsibility can visualize their importance. No detail is so small that it can be over looked. Equipment should be ordered sufficiently in advance of the start of the project so that there can be no possible delay and that shortages can be secured from the factories. Time spent in the careful planning and arrangement of the work will be paid many times over by the efficient manner in which the project will move forward when once under way.

Respectfully submitted,



James C. Evenden
Associate Entomologist.

EXTRACT

Beaverhead - Bitterroot Forest Insect

Control Project.

November 24, 1926.

PLAN OF OPERATION

Supervision

Due to the extremely large territory which this project covers, especially within the Big Hole Basin, the marking of the infested trees for treatment will be one of the most important phases of the work during the coming season. In this phase of the work, men who have a working knowledge of a compass, who can pace accurately and map the areas cruised, will be required to take charge of the spotting crews. Furthermore, it will be necessary to send these men into areas ahead of the control crews for the purpose of securing more accurate data relative to the status of infestation as well as the marking of infested trees for treatment. So in addition to the qualifications required for a chief of spotting crew, men of responsibility who have more than a mercenary interest in the work, must be secured, as many phases of the project will rest upon their information and decisions. These men should be carefully selected as in reality they will become assistants to the officer in charge of the project. It is believed that at least six men of this character will be required for the successful execution of the work within the Big Hole Basin and four within the Bitterroot drainage. At least ten days prior to the starting of control work these men should be assembled in one centrally located camp in order that instruction can be given them in the various phases of the work.

Spotting

Inasmuch as there are no trees within this project which have been actually marked for treatment it will be necessary to start the survey work on a rather large scale ten days prior to the arrival of the control crews. To effectively carry on this work the men acting as spotters must receive a somewhat careful training. They should be carefully selected, as the duties of a spotter are exacting and rather severe, and assembled ahead of the control crews in time to start the spotting as planned. Ten of these men will be required for the carrying on of the work within the Beaverhead National Forest and six within the Bitterroot. Details of the methods of survey, mapping, and marking of trees will be furnished at a later date.

Details of Operation

A somewhat detailed plan of operation has been prepared by the writer as a basis upon which to start the operation. Though it is fully realized that corrections and additions will no doubt be necessary it is believed that if this plan is followed it will result in the starting of the project in a satisfactory manner. This plan is to show the need for the careful planning of the small details in order to prevent the lost motion which so often occurs at the beginning of these projects. The writer wishes to stress the importance of not being in too great a hurry to start the actual control work. This work can be more efficiently directed with a correspondingly reduced cost per treated tree if the spotters are far ahead of the control crews.

Though a great deal of duplication occurs this plan is given for both the Beaverhead and the Bitterroot National Forests.

Beaverhead National Forest (Big Hole Basin).

Due to the size of the area to be covered it is believed that it will be necessary to actually carry on control work within Control Units #2 and #3 and no doubt #1 at the same time. Though this will mean a decentralization of force and will result in more difficult supervision, the difficulty and expense of the frequent moving and directing of the large camps which would be necessary if an attempt was made to work straight through the area would more than offset these objections.

I. Two weeks prior to the arrival of the control crews the six men who have been selected as assistants to the officers in charge of the project, as chiefs of spotting crews, camp foreman, etc., should be assembled and located at a camp previously established at the Wharton Sawmill on Mussigbrod Creek, in Control Unit #3.

   A. Field instructions could then be given these men by the Forest Entomologist and Forest Officer in general charge of the project as follows:

      1. Methods of survey.
      2. Location and marking of infested trees.
      3. Methods of Treatment.
      4. Keeping of records.
      5. Life history and habits of the mountain pine beetle.

II. Three days after the arrival of these assistants the men who have been selected to act as spotters should be assembled at the same camp. At that time they could be assigned to crews and after a brief course of instruction the spotting of the Wharton Sawmill areas could be started.

A. The best results, especially at first while the men are being trained, will be secured from a three man crew. The chief or compassman and two spotters each covering a strip one chain wide on each side of the compassman. This survey should be made by sections and the infested trees mapped upon Forest Service forms 878.

III. Prior to the arrival of the control crews at the Wharton Sawmill camp, spotter's camps should be established as follows:

A. In completing the work in Control Unit #3, spotting should be started in the Bender Creek and Mussigbrod Creek areas.

B. At the Battlefield in order to take charge of the spotting within Control Units #2.

C. An extensive survey followed by intensive spotting, if necessary, within Control Unit #1.

D. If funds are available the project should close on Control Unit #4. By leaving this unit until the last the question of having sufficient funds to treat the infested trees upon the other and more important units would be settled.

IV. Ten days after the starting of the spotting within the Wharton Sawmill area at least one control crew should be established. The need for more than one crew can best be determined after the first few days of spotting.

A. It was found that where the brush is to be piled and burned a crew of seven men gave the best results. However, it is believed that if the brush is left, the same volume of work could be produced with only five men.

V. As soon as the spotting within the different areas has progressed sufficiently far to enable the efficient directing of control work treating crews should be sent into these areas.

A. The number of these crews required is difficult to determine and will depend entirely upon the severity of the infestation within the areas of the different units. After the project has been under way for some two or three weeks, if it is found that the spotting is progressing faster than the actual control work, then additional control crews can be added.

VI. As the work is completed within each area of the different con-

trol units the spotters and control crews will move into the remaining areas until that unit is completed.

Bitterroot National Forest.

I. Two weeks prior to the arrival of the control crews the four men who have been selected as assistants to the officer in charge of the project as chiefs of spotting crews, camp foreman, etc., should be assembled and located at a camp previously established on the head of the Springer Creek drainage.

A. Field instructions could then be given these men by the Forest Entomologist and Forest Officer in general charge of the project as follows:

1. Methods of survey.
2. Location and marking of infested trees.
3. Methods of treatment.
4. Keeping of records.
5. Life history and habits of the mountain pine beetle.

II. Three days after the arrival of these assistants, the men who have been selected to act as spotters should be assembled at the same camp. At that time they could be assigned to crews and after a brief course of instruction the spotting of Control Area "C" could be started.

A. The best results especially at first while the men are being trained will be secured from a three man crew. The chief or compassman and two spotters each covering a strip one chain wide on each side of the compassman. Inasmuch as this territory is unsurveyed it will be necessary to utilize trails, streams, and ridges for base lines from which the cruise can be made. Infested trees should be mapped upon Forest Service Forms 878.

III. Prior to the arrival of the control crews at the Springer Creek Camp spotter's camps should be established as follows leaving one crew in this area to complete the spotting if necessary.

A. Two spotting crews should be located at the 4 B Cabin in order that at least one week's spotting can be accomplished before the institution of control work within Control Area "B". This advanced spotting is essential for the determining of the size of the treating crews required and the proper directing of the work.

B. One spotting crew should be located in a camp in Control Area "A". This area is an extremely large one and the infested trees are badly scattered, so a tremendous amount of work will be required before sufficient data can be secured which will enable the formulation of a comprehensive plan of action. From two to three weeks will be required before these data can be secured.

C. Though it will be best to establish a spotting crew within area "D" a day or two prior to the institution of control work, the infestation is of such a character that the spotting could be started at the same time as the control operation.

D. If funds are available for the institution of control work within Control Area "E" very little spotting will be required as the infestation is of such a character that it will permit of almost continuous work throughout the region.

IV. Ten days after the starting of the spotting within Control Area "C" (Springer Creek drainage) a small control crew should be established. The size of this crew can best be determined after the first few days of spotting.

A. In using the burning method developed in the Big Hole Basin last season, it was found that where the brush is to be piled and burned, a crew of seven men give the best results. However, if the brush is left the same volume of work could be produced with only five men.

V. As soon as the spotting within Control Areas "A" and "B" has progressed sufficiently to enable the efficient directing of control work, treating crews should be established within these areas.

A. The number of treating crews required is difficult to determine and will depend entirely upon the severity of the infestation within the different areas. After the project has been under way for some two or three weeks additional crews can be added if required.

B. If funds are available for the institution of work within Control Area "E" a rather large crew could be efficiently directed from the Sage Brush Hill Camp.

VI. As the work is completed within each area, the spotters and control crews can move into the remaining untreated areas if necessary.